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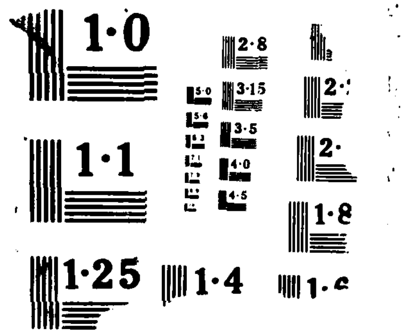
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AIR COMMAND AND STAFF COLLEGE

STUDENT REPORT

ANTISATELLITE WEAPONS
AND
SATELLITE DEPLOYMENT STRATEGIES

MAJOR RANDALL W. CHAPMAN 88-0510

"insights into tomorrow"

47

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REPORT NUMBER 88-0510

TITLE ANTISATELLITE WEAPONS AND SATELLITE DEPLOYMENT STRATEGIES

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Submitted to the faculty in partial fulfillment of
requirements for graduation.

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Space is becoming a more and more likely arena for future combat. The strength of future US antisatellite capabilities and the survivability of US satellites will determine if space power supports US national security. The study evaluates the oft stated conclusion that ASATs destabilize superpower relations. The study concludes that the actual sources of instability are the weaknesses in current US military space strategy. These weaknesses are (1) failure to deploy ASAT systems and (2) continued reliance on a small number of highly vulnerable, complex, multipurpose satellites. Deployment of a US ASAT and a move to a more survivable satellite deployment strategy--suggestive of current Soviet practices--will be stabilizing influences in superpower relations.

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PREFACE

The purpose of this paper is to analyze US military space strategy within the context of warfighting. Although US space strategy today adequately supports peacetime requirements, it inadequately provides a true warfighting capability in two critical areas. First, the US cannot deny the advantages of space to its adversaries. Without a deployed antisatellite system, the US cannot deal directly with the Soviet threat from space. Second, in the face of an operational Soviet antisatellite system, the current US satellite deployment strategy is risky. Warfighting capabilities that only space systems can provide may be easily denied by the Soviets. This paper concludes that the US must deploy an antisatellite system, but at the same time, the US must move to a more prudent satellite deployment strategy to include the launching of many single-purpose satellites.

This paper is aimed at those officers who must determine and advocate the future US military space force structure. By mixing the best of Soviet and US space practices, these officers can develop a superior space warfighting strategy.

I would like to thank my advisor, Lt Col Larry G. Roseland, for his timely guidance essential to completing this study. I would also like to thank Lt Col David A. McDermott and Major Harrison Freer of Air Force Space Command for their sponsorship and advice in this effort. Special thanks go to 1st Lt Marc Powell, also of Air Force Space Command, for reviewing and commenting on an early draft. Without the assistance of all these people, this research effort would not have been possible.

Finally, I wish to acknowledge the patience, understanding, and support I received from my family. Martha, Ashley, and Ryann are what national security is all about.

ABOUT THE AUTHOR

Major Randall W. Chapman graduated from the United States Air Force Academy in 1975 with a Bachelor of Science Degree in Physics. Upon graduation he received a regular commission in the USAF and attended Undergraduate Pilot Training at Craig AFB, Alabama. After receiving his wings in October 1976, he served as a T-33 pilot at Duluth AFB, Minnesota; as an F-106 fighter-interceptor pilot at Castle AFB, California; and as an A-10 fighter-attack pilot at RAF Woodbridge, United Kingdom. While at RAF Woodbridge, he completed the requirements for and received a Master of Science Degree in Systems Management from Troy State University in May 1983. He then entered the School of Engineering at the Air Force Institute of Technology in June 1983 and graduated in December 1984 with a Master of Science Degree in Space Operations Management. His thesis, coauthored with Major (now Lt Col) Peter H. Rensema, was titled "A Decision Support Methodology for Space Technology Advocacy." After AFIT he became an action officer at HQ Air Force Space Command, working for the Deputy Chief of Staff for Operations in the Directorate of Space Systems and Activities. His projects included the upgrade of the Space Defense Operations Center (SPADOC 4), the US Air-Launched Antisatellite program, and the Strategic Defense Initiative Organization's Delta 180 experiment which was successfully launched in September 1986. As Chief, Space Control Requirements and Plans Branch, Major Chapman developed requirements and operational plans for space control operations, analyzed space debris issues and their long-term threat to space systems, and staffed several recommendations on the command and control arrangements between the United States Space Command and its component commands. Following Air Command and Staff College, Major Chapman will return to flying duties in the A-10 at Suwon, Korea. His permanent home address is 1930 Pablo Vista, San Pablo, CA 94806.

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EXECUTIVE SUMMARY

REPORT NUMBER 88-0510

AUTHOR(S) MAJOR RANDALL W. CHAPMAN, USAF

TITLE ANTISATELLITE WEAPONS AND SATELLITE DEPLOYMENT STRATEGIES

I. Purpose: To establish that deployment of a US antisatellite (ASAT) weapon system and a move to a more survivable satellite deployment strategy--suggestive of current Soviet practices--will add balance and stability to superpower relations.

II. Problem: Many view the development of increasingly capable ASAT systems as a destabilizing factor between the superpowers. This view ignores current weaknesses in US military space strategy that are the actual factors that lead to instability. These weaknesses are (1) failure to deploy ASAT systems and (2) reliance on a small number of highly vulnerable satellites.

III. Data: The US and the Soviets are both coming to rely more and more on space systems to effectively employ their conventional and nuclear military forces. This has created strong incentives to develop ASAT weapons to deny an adversary support from space. Technology has made satellites more capable and thus more threatening. At the same time, advanced ASAT technologies will put these satellites at increasing risk.

The Soviets currently have the only operational ASAT system. They also have a satellite deployment strategy that ensures continued support from space throughout all levels of conflict. Although the US recognizes the need for ASATs and survivable satellite deployment strategies in its space doctrine, it lacks the will to deploy an ASAT system and continues to rely on a small number of highly vulnerable, complex, multipurpose satellites. These serious weaknesses in current US military strategy add imbalance and instability to superpower relations.

Possession of ASAT systems by both superpowers will lead to mutual, but stable, vulnerability in space. More survivable satellites would strengthen the underlying dynamics of nuclear deterrence. In conventional conflict, ASATs provide operational flexibility to commanders in the field and can deter aggressive Soviet satellite behavior. As more countries launch satellites with inherent military capabilities, both superpowers could view this as a further proliferation of hostile satellites. This will further complicate national space strategy. Moreover, incentives already exist--and may be growing--for other countries to acquire capabilities to interfere with satellites hostile to their national interest. ASAT proliferation may become an issue of the future. ASATs will also be a critical factor in any decision to base elements of a multilayered ballistic missile defense system in space.

IV. Conclusions: The US today is not ready to meet an enemy in space. The current US military space program is well suited for peacetime operations but dangerously ill-prepared to deter or conduct warfare in space. The US space program is unusually fragile and lacks reserves for crisis or contingencies. Deployment of a US ASAT system can deter aggressive Soviet satellite behavior. Moving to a more survivable satellite deployment strategy can help to reduce aggressive Soviet ASAT activity. As other countries launch satellites with inherent military capabilities, both US and Soviet military space strategies will face increasing complexity.

V. Recommendations: The US must treat space as a possible theater for war. To enhance deterrence and, at the same time, prepare to wage war in space, the US should aggressively pursue a variety of ASAT development programs, including deployment of the F-15 air-launched ASAT. The US should also adopt a more survivable satellite deployment strategy similar to current Soviet practices. This strategy would consist of three elements: (1) place into orbit larger constellations of smaller, single-purpose satellites; (2) stockpile satellites and boosters to ensure damaged or destroyed satellites are rapidly replaced; and (3) build a launch and on-orbit support infrastructure that can deploy and support the larger number of satellites.

Chapter One

INTRODUCTION

The emptiness and void of space has not yet felt the sting of battle. But, as an arena for combat *in futuro*, space is fast becoming more attractive. In a prepared statement before Congress in March 1979, former astronaut and Deputy Chief of Staff of the Air Force for Research and Development General Thomas Stafford stated, "Under certain circumstances space may be viewed as an attractive arena for a show of force. Conflict in space does not violate national boundaries, does not kill people, and can provide a very visible show of determination at relatively modest cost." (10:323)

Two important elements are needed for conflict in space--satellites and antisatellite (ASAT) weapons. Satellites and ASATs are fundamental to national space power. The strength of future US ASAT capabilities and the survivability of US satellites will determine whether US space power supports national security. ASAT capabilities can deter aggressive Soviet behavior in space or, during conflict, deny Soviet forces the benefits of their satellites. Likewise, survivable satellites can deter Soviet ASAT attacks and ensure US forces enjoy their force multiplying functions throughout the spectrum of conflict. Although survivable satellites reinforce stability, many view ASATs as a destabilizing factor in superpower relations. (7:147; 10:253)

In Space and National Security, Paul B. Stares echoes this conclusion: ASAT weapons, if aggressively developed and extensively deployed, will be a destabilizing factor between the superpowers. (11:1) This paper challenges that conclusion. The purpose of this paper is to argue instead that weaknesses in US space strategy are the major source of instability in superpower space relations. These weaknesses are (1) a failure to deploy ASAT systems and (2) continued reliance on small numbers of complex, multipurpose satellites which could not survive a Soviet ASAT attack. Deployments of a US ASAT and more survivable satellites, suggestive of Soviet practices, will provide stability in superpower space relations.

To develop this argument, Chapter Two describes satellites and ASATs. Satellites are described in the context of being ASAT targets: Why satellites threaten and thus must be threatened; Why they are so vulnerable; and How they can be made less vulnerable. ASAT weapons and their characteristics are then identified and categorized.

Chapter Three compares Soviet and US space doctrines and strategies. The Soviets have no doubt that ASATs are the main and growing source of offensive combat power in space. They have therefore developed the launch and reload capabilities needed to both attack US satellites and replace Soviet space assets lost during war. (23:2) Although the US has a reasonable space control doctrine and superior space technology, it has failed to translate either into an effective space warfighting strategy. (21:45)

Chapter Four explores four issues. The first two deal with the relationship of ASATs to nuclear deterrence and conventional conflict. Both discussions center on arguments found in Stares' Space and National Security. The third issue looks at the effect other countries will have on superpower space relations. Several countries already operate satellites with inherent military capabilities. Also, ASAT proliferation may eventually become an issue as countries seek to deny the advantage of space to their adversaries. The final issue is the association of ASATs with ballistic missile defenses (BMD). By controlling access to space, ASATs will be a critical factor in any decision to base elements of a multilayered BMD system in space. Satellite deployment strategies are discussed for each of these issues.

Chapter Five digests the results from the preceding chapters to conclude that the US space program currently lacks the characteristics needed to deter or conduct warfare in space. This result entreats the US to develop and deploy a variety of ASAT weapons and adopt a strategy of deploying many simple, single-purpose satellites suggestive of current Soviet practices. In this way, the US can be prepared for war in space and, at the same time, add balance and stability to the space arena and to superpower relations in general.

Chapter Two

WEAPONS AND TARGETS

According to the Soviet military author L. Tkachev, "In the future, space will become the principal theater of military operations." (22:34) Two others, G. Sibiryakov and A. Khabarov, believe "Whoever can seize control of space--that main area of future war--will be able to change the correlation of forces so decisively that it will be tantamount to establishing world supremacy." (22:34) This chapter describes the two important elements needed in any military strategy to seize control of space--satellites and ASATs.

SATELLITES--THE TARGETS

The heart of any viable military space strategy is the satellite. To understand the relationship between satellites and ASAT weapons, three questions must be explored: (1) Why do satellites threaten and thus must be threatened? (2) Why are satellites easy prey to ASAT attack? and (3) How can satellites be made less vulnerable?

Answering the first question--Why do satellites threaten and thus must be threatened?--requires an understanding of the value of satellites to national security. In peacetime, satellites support deterrence and treaty verification. They also provide military forces with many force multiplying functions. Some of these functions are surveillance, reconnaissance, communications, targeting, meteorology, terrain mapping, and navigation. These functions can dramatically improve the effectiveness and efficiency of military forces. (22:34)

The second question--Why are satellites easy prey to ASAT attack?--is answered by pointing out that satellites have certain characteristics that make them vulnerable to ASAT attack. First, satellites operate in the relative vacuum of space and obey simple physical laws. This makes satellite positions easy to predict and thus easy to target. Second, the openness of space exposes satellites to the unrestricted view of a variety of sensors. This makes satellites easy to detect and track. Third, satellites move through space at relatively large velocities. This makes satellites vulnerable to any collision. Both superpowers have exploited these characteristics. Each has already successfully tested ASATs and are developing even more lethal weapons. (6:51-53; 11:113-118)

Answering the third question--How can satellites be made less vulnerable?--requires a look at four basic survivability strategies: (1) substitution, (2) countermeasures, (3) legal and diplomatic measures, and (4) devaluation.

Substitution means reducing vulnerability by using earth-based systems to do the functions now done by satellites. For example, some reconnaissance now done by satellites could be done with reconnaissance aircraft. However, as this example shows, substitution does not allow the unique opportunities and characteristics of space to be fully exploited (i.e., overflight rights for treaty verification and global access). (10:14-15)

Countermeasures, on the other hand, let satellites exploit space while reducing vulnerability to ASAT attack. A variety of countermeasures are available: stealth, decoys, maneuvering, hardening, proliferation, on-orbit spares, anti-antisatellites (commonly referred to as defensive satellites or DSATs), self-defense capabilities (onboard weapons to attack attacking ASATs), electronic counter-countermeasures (ECCM), and electro-optical counter-countermeasures (EOCCM). (13:4) These countermeasures can be mixed and matched to defeat a particular type of ASAT.

Legal and diplomatic responses are also available to help reduce satellite vulnerability to attack. For example, each spacefaring nation could declare and try to defend a protective zone, or keep-out zone, around its satellites. These zones, along with negotiated rules of the road to restrict provocative activities in space, could be an integral part of any arms control agreements to limit the threat from ASATs. (4:8-9) Unfortunately, legal and diplomatic responses have proved difficult to negotiate and provide no guarantee that an aggressor will adhere to them in the future.

Devaluation is a strategy of launching many simple, single-purpose satellites and rapidly replacing those damaged or destroyed. Devaluation makes an attack on each satellite less profitable. Each satellite represents only a small percentage of the total capability of a large constellation of satellites, and each satellite is easily replaced. Devaluation is a combination of proliferation and replenishment (i.e., replacement and reconstitution).

Each of the above strategies would require various tradeoffs in cost, efficiency, effectiveness, and enforceability vis-a-vis each ASAT weapon type. However, even the most vigorous satellite survivability program will not provide full protection from existing and future ASAT weapons. (13:9-10)

ASATs--THE WEAPONS

A variety of methods exist that reduce the threat from orbiting satellites (e.g., force augmentation, deception, concealment, and disguise). ASAT weapons, however, are the most direct way to defeat satellites. Some have defined the mission of ASAT weapons as one of destroying "vital components of an adversary's network for intelligence gathering and for the command and control of his own forces." (7:147) A simpler but more revealing mission statement is that ASATs control access to space even to the point of denial. In this context, the acronym ASATs will be used to describe all weapons and techniques that can either degrade, neutralize, disable, or destroy an orbiting satellite.

The Office of Technology Assessment classifies ASATs as (1) inadvertent but inherent, (2) planned, or (3) advanced. The first category includes weapons that could be adapted for some crude ASAT capabilities. Some candidates are intercontinental ballistic missiles (ICBMs), sea-launched ballistic missiles (SLBMs), BMD systems in the research and development (R&D) phase, or technology demonstrations such as the Homing Overlay Experiment. Because the US Space Shuttle and the Soviet shuttle can pick up and return satellites to earth, they too would have some inherent ASAT capability. Almost any highly maneuverable spacecraft with a rendezvous capability could be used in an ASAT role. (13:4-5)

Planned ASAT weapons are the US F-15 air-launched ASAT and the Soviet co-orbital ASAT. This category would also include any clandestine, but nonetheless intentional, ASAT development.

Advanced ASAT weapons are classified by the method of use or by the technologies involved. These ASATs are space mines, electronic weapons, high-power radio frequency weapons, high-energy lasers, kinetic-energy weapons, and neutral particle beam weapons. (13:7-8) Space mines could be disguised as other types of satellites, or as part of otherwise legitimate satellites. The nature of space mines lend themselves to deniable or presumed accidental destruction of high value military or civil satellites. (13:7)

Electronic weapons include electronic and electro-optical warfare. Many existing terrestrial techniques and technologies could be readily adapted to space warfare. Jamming, spoofing, dazzling, or blinding satellite systems and sensors are some examples. Both electronic countermeasures (ECM) and electro-optical countermeasures (EOCM) require detailed knowledge of the characteristics of the target satellite system. (13:4)

Related to electronic weapons are high-power radio frequency weapons. They use high-power microwave or radar beams to jam, overload, or burn out the electronics on a satellite. Two drawbacks exist to this type of weapon. First, its use is probably detectable, making clandestine use unlikely. Second, because no debris results from this type of

attack, it would be difficult to determine if the attack was successful. (13:7)

High-energy laser weapons can "jam" optical systems on satellites or cause permanent damage to these sensors at higher power levels. Laser weapons also do not lend themselves to unambiguous strike assessment. (13:7-8)

Kinetic-energy weapons collide with the target satellite at high velocities to destroy it by exchange of kinetic energy. This class of weapons presents the easiest strike assessment problem. The resulting space debris can be tracked by space surveillance systems. The US F-15 air-launched ASAT is a kinetic energy weapon. Future types could be improved derivatives of this system. (13:8)

Neutral particle beam weapons are a theoretically attractive ASAT weapon type. From the vacuum of space, a powerful particle accelerator could accelerate neutrons to such a velocity that they could effectively destroy a satellite. These weapons have not yet proven feasible to deploy. (4:141-159)

Each of these ASAT weapons has different engagement characteristics. For example, a ground-based laser can attack satellites at higher altitudes than the US F-15 air-launched ASAT system. Several types of ASATs might need to be deployed to cover all the altitudes of the satellite target set. Deploying more than one type of ASAT also makes satellite defense more difficult. For example, a satellite with a robust maneuvering capability could evade relatively slow-moving, kinetic-energy weapon attacks. However, in the face of a ground-based laser operating at the speed of light, this maneuvering capability would prove unsatisfactory. A variety of weapons thus provides operational flexibility and hedges against countermeasure development.

Any ASAT engagement can be broken down into rather classical phases: target acquisition, tracking, discrimination, interceptor or weapon control and pointing, target kill, and post-strike assessment. Each phase requires a complex and worldwide space surveillance system. Space surveillance data is used to locate, identify, and target satellites and can remove uncertainty behind the causes of otherwise ambiguous incidents or accidents in space. If a satellite is attacked, space surveillance systems provide strike assessment. If a satellite is mysteriously destroyed, space surveillance systems provide the information necessary to determine if the event was caused by hostile action or natural events. (11:185) Space surveillance systems are also used to verify compliance with space and ballistic missile treaties. (11:162) And, if space does become an arena for combat, space surveillance systems will be a critical factor in how ASAT weapons and satellites are used. Improved space surveillance systems would be a necessary part of any Soviet or US decision to deploy advanced ASAT systems. The next chapter explores Soviet and US thinking on such decisions.

Chapter Three

MILITARY SPACE DOCTRINE AND STRATEGY

The US and the Soviets are both coming to rely more and more on space systems to effectively employ their conventional and nuclear forces. (11:1) In fact, former Commander-in-Chief of the United States Space Command and now Vice Chairman of the Joint Chiefs of Staff General Robert T. Herres stated that space systems dramatically change the conduct of military operations.

> Commanders operating military forces today conduct operations without many of the uncertainties that plagued their predecessors. Because of the support space-based systems provide, commanders have better data on weather conditions and can use such information to their advantage. They know with far more confidence the strength and disposition of the forces they face, and they are more certain of the disposition of their own forces. This knowledge has been historically decisive in the outcome of military operations. It is clear that the use of space can provide a decisive edge. Modern military forces cannot expect success if they are denied that edge while operating against forces who enjoy the support provided by space-based systems. (11:4)

For effective and "decisive" military operations today, friendly satellites must be protected from attack. At the same time, the enemy must be denied the advantages of his satellites. Correspondingly, this chapter describes the current Soviet and US doctrines on satellite denial--ASAT warfare (a part of space control)--and analyzes the critical implications of each doctrine for the Soviet and US space programs, especially satellite deployment strategies.

SOVIET DOCTRINE AND STRATEGY

The doctrine behind Soviet military space forces has been succinctly stated by the Defense Intelligence Agency.

> The Soviet Armed Forces shall be provided with all resources necessary to attain and maintain military superiority in outer space sufficient both to deny the use of outer space to other states and to assure maximum space-based military support for

> Soviet offensive and defensive combat operations on land, at sea, in air, and in outer space. (14:32)

"To deny the use of outer space to other states," the Soviets have developed and deployed the only operational ASAT system in the world and are expanding and improving their ASAT capabilities. Their co-orbital ASAT system was first tested in 1968 and was considered operational as early as 1971. (5:155) Moreover, the Soviets have two ground-based laser test facilities that may be able to interfere with satellites in low earth orbit. A third facility is now under construction near the Afghanistan border. The three facilities together will provide targeting opportunities for almost all low altitude satellites at least once every day. (6:50-52) The Soviets are also investigating BMD technologies that could provide ASAT capabilities in the future. (5:168)

This ASAT development allows the Soviets to pursue either selective attack strategies or attrition warfare in space. ASATs are well suited for selective attacks on a limited set of satellites (e.g., photoreconnaissance satellites in low earth orbit). In many scenarios, selective ASAT attacks on US or Allied satellites could be a controllable and nonescalatory Soviet strategy. Selective attacks can be structured to control destruction, confine the combat arena to space, achieve limited objectives of denial, and offer a less than suicidal option to Soviet decision makers. (5:196-197; 24:40-41) The Soviets also believe that the ASAT can be used in attrition warfare to gain supremacy in space. Attritional attacks would seek to deny both the use of and the free access to space. (14:13) Both selective and attritional attacks would be bloodless, denying an adversary an emotional stick to wave at public opinion. Thus, both attack strategies offer little incentive for adversaries to escalate to bloodier conventional or nuclear options. If this is true, the Soviet satellite deployment strategy is uniquely suited to survive and endure attacks against their own satellites.

The current Soviet satellite deployment strategy, in keeping with their doctrine, allows them "to assure maximum space-based military support for Soviet offensive and defensive combat operations." (14:32) The Soviets deploy the largest constellations of satellites and have the best launch and replacement capabilities in the world. They have shown that they can rapidly launch and replace many of their critical military satellites. (16:iii) This fact alone may moderate their reaction to the loss of one of their satellites. A rational reaction would be to replace the satellite rather than escalate to higher levels of conflict. This clearly gives the Soviets a considerable degree of control in a crisis. This control is possible because satellite replenishment is an inherent characteristic of Soviet satellite survivability.

The Soviet satellite survivability program has two major elements: proliferation and replenishment. Together they constitute a devaluation strategy. "The large number of Soviet satellites. . . deters attacks and results in a graceful decline in capabilities as members are

negated, while in many cases replacements can be in orbit in a matter of days." (5:203) The initial Soviet decision to pursue this strategy probably resulted from technological limitations. (5:203) However, its continuance provides singular advantages in terms of dispersion. Even with these advantages, the Soviet space program is still often described as inferior to the US space program. (11:44; 17:154; 21:43)

For many years the Soviet space program was characterized as technologically inferior to the US program. A technology gap existed. (11:11) Specifics about this gap are hard to find because of the secrecy surrounding both the Soviet space program and the best US satellite technologies. (2:132-134; 5:23-25) Developments over the last several years suggest that if the gap existed, it has been effectively bridged. For example, the Soviets conduct approximately 100 space launches each year, with a capability to launch either on demand or on schedule. This is four to six times as many as the US annual rate and gives the Soviets a distinct operational advantage in space. Also, satellite lifetimes and survivability can be expected to increase in the coming years because of improvements in technology and placement of their satellites in higher orbits. These higher orbits will increase fields of view and reduce vulnerability to ASAT attack. (15:53) The failure to recognize these superior warfighting characteristics of the Soviet space program is reflected in the US failure to implement an otherwise reasonable doctrine of its own.

US DOCTRINE AND STRATEGY

United States doctrine is fundamentally the same as Soviet doctrine. US doctrine states the need to both deny satellite capabilities to the enemy and maintain access to space to ensure US forces are provided the decisive advantages inherent in space-based systems. Indeed, denial and free access are the fundamental objectives of space control. US ASAT doctrine lies within its space control doctrine.

Space control operations are described in AFM 2-XK, Aerospace Operational Doctrine: Space Operations (Draft).

> Space Control Operations. These operations provide freedom of action in space for friendly forces while, when directed, denying the same to an enemy. Space control operations are conducted to protect essential space systems and friendly terrestrial assets and areas from enemy forces operating in or through space. Such operations are also conducted to assure friendly forces access to and operations in space and to negate enemy space forces. The forces employed for space control are the space control forces of the Air Force.
>
> a. Aerospace and surface operations increasingly depend on space-based capabilities for support and direct contribution

toward achieving mission objectives. Interruption or impairment of space-based capabilities could directly affect the outcome of military operations. Therefore, when a threat to space systems is present, space control operations must receive the highest priority.

b. The freedom of movement and the opportunity for initiative resulting from control of space make overall military objectives more readily achievable. The degree of control may range from total control by the enemy to total control by friendly space forces. The extent of space control operations required is determined by the degree of control and the nature of opposing forces. The objectives of space control operations could range from specific system security to local control of selected orbits or altitudes to general control over access to and operations in the entire volume of space near earth.

c. Space control operations may require coordinated actions by other aerospace and surface forces to negate enemy capabilities and deny an enemy access to space. Strategic and tactical actions, both defensive and offensive, will be needed to establish and maintain control of space. (25:2-2 - 2-3)

Department of Defense (DOD) space policy supports this USAF space control doctrine, calling for development and deployment of systems for space control. "DOD will develop and deploy a robust and comprehensive antisatellite capability with programs as required and with initial operational capability at the earliest possible date." (26:1,7) In the face of congressional budget cuts and testing ban, the USAF has been hard-pressed to implement this policy. The ASAT program was restructured and now has three basic elements: (1) Continue the present F-15 air-launched ASAT program--conduct three tests in space during 1988, restart production verification, and request production funds for 1989. (2) Accelerate ongoing studies to select the best way to improve the altitude capability of the miniature vehicle ASAT (MV-ASAT). The study will compare improvements to the F-15 air-launched lower-stage booster versus developing a ground-based system using an off-the-shelf booster like the Pershing II missile. (3) Help the Strategic Defense Initiative Organization fund a ground-based laser technology demonstration effort. A ground-based laser system would complement the MV-ASAT and complicate an adversary's ability to defend his satellites. (11:116-117; 27:1-2)

Doctrine and policy notwithstanding, the US space program has no operational capability to attack, destroy, or otherwise deny to an adversary the space-based elements of his space forces. The US can pursue neither selective nor attritional strategies to control space. Nonetheless, the US has an option of sorts. Doctrine points out that the US can employ other aerospace and surface forces to control space. The US could attack the Soviet space infrastructure using conventional or nuclear means. Destroying the Soviet space forces at their origin

could rapidly deplete Soviet space resources. The relatively short life of Soviet satellites would accelerate this process. However, the Soviets would undoubtedly view such "attacks against interior, or homeland, facilities as highly escalatory." (21:45) Any attack on Soviet launch sites or satellite control complexes would lead to serious escalation of any conflict. Short of risking vertical or horizontal escalation to nuclear or conventional war, the US has no warfighting capability to control a crisis in space.

Some control would be available if the US deployed the F-15 air-launched ASAT system. However, the US Congress does not support testing the air-launched system in space and will not authorize funds for production. (19:16) Without the national resolve to fund, develop, and deploy an ASAT system, the US is severely limited in its options to control space. The current Commander-in-Chief of the United States Space Command, General John L. Piotrowski, recognizes these limitations.

> An operational US ASAT could deter the Soviets from using their own arsenal of antisatellite systems. Thus, a relatively inexpensive bullet [referring to the air-launched miniature vehicle] could, by its ability to destroy high value Soviet spacecraft, deprive the Soviets of an incentive for attacks against US spacecraft. Should deterrence fail, a US ASAT also enables a response-in-kind. An equivalent response, in turn, provides the United States with escalation control options that could deter higher forms of conflict, while still neutralizing threatening elements of the Soviet space force at lower conflict intensities. While the option of attacking Soviet launch facilities still would exist, a US ASAT could provide the ability to pursue alternative and more moderate courses of action.
>
> This is not to argue that we should acquire an ASAT to be prepared for a war of attrition in space; we should not. Rather, acquisition of an operational US ASAT could help, in coordination with other capabilities, to convince the Soviets that the costs of aggression in space or elsewhere would most certainly exceed any probable gains. A US ASAT would bolster deterrence and would be valuable for war fighting [sic]. (21:45)

Whether the US ASAT will deter Soviet use of their ASAT is arguable. The belief that an ASAT capability will deter Soviet aggression in space is often used to justify the continued funding of the US ASAT program. But, the Union of Concerned Scientists believes "the best deterrent to Soviet ASAT attacks is Soviet awareness that US satellite functions are diversified and hardened and adequately supplemented by non-satellite systems, so that an attack on satellites would not succeed in crippling the overall US military capability." (12:22) Unfortunately, the current US satellite deployment strategy would be unable to satisfy national security requirements in the face of Soviet ASAT attacks. (19:16)

The current US satellite deployment strategy lacks a fundamental characteristic needed for warfighting--the ability to quickly replace damaged or destroyed satellites. In this respect, the US lead in technology is a double-edged sword. United States space systems, based on superior engineering and technology, have long on-orbit lifetimes, are highly reliable, and perform a multitude of functions better than equivalent Soviet systems. (11:12) These characteristics enable the US to rely more on on-orbit spares than the Soviets. (11:13) The US thus needs a relatively small number of these highly sophisticated, long-lasting, and often multifunction satellites. (5:195) This reduces the need for robust launch and replacement capabilities. (11:43) The Challenger disaster and the booster failures in 1985 and 1986 showed dramatically just how limited the US ability is to replenish space systems. (11:8) Superior technology notwithstanding, the US had no capability to rapidly recover from these accidents. Translating superior technology into usable space power requires a change in the current US satellite deployment strategy.

A frequently discussed change is to adopt a strategy of deploying many simple, single-purpose satellites. In the past, "the United States has repeatedly re-examined the pros and cons of many, simple satellites versus few, complex satellites and consistently selects the latter approach." (5:195) Until the recent launch failures, the US enjoyed considerable success with this approach. Now, however, the single-purpose satellite enjoys renewed interest. (28:1)

Single-purpose satellites have several desirable features and can meet a variety of military requirements. They are smaller, less complex, less expensive, easier to launch quickly, and can be launched on less vulnerable mobile launchers. More can be built and stored, reducing the reconstitution problem. Larger constellations are possible for the same cost. Replacement satellites can be scheduled for launch more frequently. At any level of conflict, launch doctrine can vary between launch-on-schedule and launch-on-demand depending on constellation requirements. These fuller constellations will take longer to degrade, or would require a larger overall attack effort, than do sparse constellations of more expensive systems. This will increase survivability. Single-purpose satellites thus solve both the vulnerability and endurability problems. (28:1-2)

Single-purpose satellites also add flexibility to military planning. In the face of a new threat, a single-purpose satellite is more easily customized to defeat that threat. Customized service can also be provided to end-users. Whereas multipurpose satellite tasking must be allocated based on the conflicting demands of competing end-users, the single-purpose satellite is perfectly capable of providing dedicated service to a commander in the field. The single-purpose satellite clearly provides warfighting capabilities not now available in the current US military space program. (28:1-2)

To summarize, the Soviets possess an operational ASAT system and are probably developing others. They also possess a robust and active satellite deployment strategy--one capable of warfighting. On the other hand, US space strategy relies on the US lead in space-related technologies. However, this lead is offset by two important weaknesses: (1) no operational ASAT systems and (2) a satellite deployment strategy lacking proliferation and replenishment capabilities. These weaknesses leave the US with no reasonable capability to deter aggression in or from space or to conduct, control, and survive, much less prevail, any level of warfare in space. In the next chapter, analysis of four issues further explores the close interdependence between ASAT weapons and satellite deployment strategies.

Chapter Four

ANTISATELLITE ISSUES

This chapter explores four issues relevant to understanding the relationship between ASATs and satellite deployment strategies. The first issue is whether the presence of ASATs destabilizes nuclear deterrence between the superpowers. Paul Stares' "popular" arguments in Space and National Security are used to explore the credibility of the assertion that "the presence of ASATs" undermines nuclear deterrence by threatening the command, control, and warning functions resident on many satellites. In a similar vein, the second issue is the use of ASATs in conventional conflict. The third issue deals with third parties and their effect on the space power equation. As third parties continue to deploy satellites with military capabilities, the number of potentially hostile satellites will increase. Moreover, incentives grow for third parties to be able to interfere with satellites hostile to their national interests. The final issue is the effect of ASATs on any decision to deploy elements of a ballistic missile defense in space.

ASATS AND NUCLEAR DETERRENCE: A QUESTION OF STABILITY

Paul Stares has summarized the issue of ASATs and crisis stability.

> Unconstrained ASAT development. . . has serious implications for conflict management and crisis stability. The deployment of highly capable ASAT weapons will add new, destabilizing uncertainties to crisis situations, especially if satellites used for the command and control of strategic nuclear forces become vulnerable. Although both sides can be expected to take the necessary precautions to reduce their dependency on space-borne systems, the presence of ASAT systems could still create . . . an undesirable and potentially unstable situation in a severe crisis. With so much at stake, therefore, the United States should seriously reconsider its need for an ASAT system. (11:178)

Others have come to similar conclusions: "All the technological trends indicate that ASATs possess a considerably greater capacity for transforming a crisis into war, and for enlarging war, than they do for assisting in military missions or enhancing deterrence." (7:148) This belief--that ASAT weapons are dangerously destabilizing--leads to the judgment that a "better world necessarily involves moving toward their

elimination." (9:4) But even Stares admits that ASAT development may be inevitable: "As both superpowers increasingly use space systems for the support of military operations on earth, limits on antisatellite weapons cannot be expected to last very long. The incentives to develop these weapons will become just too great." (11:186) With development inevitable and, in fact, well underway by both superpowers, what role indeed do ASATs play in the stability of the relationship between the superpowers?

Foremost in the relationship between the superpowers is nuclear stability. History has shown that the presence of operational US and Soviet ASATs in the past has not upset nuclear stability. (10:106-134) Using a nuclear analogy, and accepting the proposition that the world has become simultaneously more deadly and less dangerous in the presence of nuclear weapons, the presence of ASAT weapons makes space more deadly but less dangerous. As Donald M. Snow points out, "The superpowers have been forced to exercise considerable and growing restraint in their relations to ensure that they do not slide into a nuclear exchange both consider unthinkable." (9:4) If one believes that satellites are inextricably linked to nuclear forces through their ability to provide command, control, and warning functions, then the deployment of ASATs by both superpowers will, by the very weight of the balance, create and reinforce stability. Stability rests on the presence of capable weapon systems, not on their absence. This clearly is a rejection of the conclusion shared by Stares and others.

Insofar as possession of ASAT systems by both sides would lead to mutual but stable vulnerability in space, any move to make satellites more survivable should further strengthen the underlying dynamics of deterrence. One way would be to dedicate certain satellites to only supporting nuclear forces, and making these satellites survivable. Unfortunately, many satellites support both nuclear and conventional forces because of the functions they perform. "For example, in addition to their tactical applications, photoreconnaissance and electronic reconnaissance satellites would be used to provide status reports on the whereabouts and readiness of each side's strategic nuclear forces." (11:137) Satellites thus become targets in both conventional and nuclear war planning. Attacks on satellites to support conventional warfare can easily be misinterpreted as attacks on nuclear command and control assets. This presents a dilemma. An aggressor may attack in the belief that his adversary will be unwilling to escalate to nuclear warfare. On the other hand, the victim may be compelled to employ his nuclear forces before he loses the ability to command and control them. To temper this dilemma, a satellite survivability program is needed that reduces both the incentive to attack and the compulsion to escalate.

A satellite survivability strategy that relies on devaluation would strengthen deterrence. Each satellite would provide minimum capability where full capability is only provided over a large constellation of

satellites. Also, if any satellite is damaged or destroyed, it can be quickly replaced. A capability to rapidly launch and replace many single-purpose satellites, plus the deployment of ASATs, would create paradox and uncertainty for the military planner. Calculation of success in a space war would thus be less persuasive and more ambiguous.

The Soviets understand the value of calculating for war in space. The synergism between their ASAT system and their strategy of rapid launch and replacement of many single-purpose satellites has made Soviet satellites more resilient to attack and less likely to be attacked. The same cannot be said of the current situation in the US space program. The assumption that the US ASAT, if eventually deployed, will deter the Soviets from using their ASAT is misguided. Unless the US moves to a satellite deployment strategy suggestive of current Soviet practices, making the balance of vulnerability more equal, the US provides the Soviets a window of opportunity to attack all but the most critical command, control, and warning satellites without fear of releasing the nuclear genie. (9:85,113)

This window of opportunity is a Soviet ability to pursue a selective attack strategy in space for limited political-military objectives in a non-suicidal way. (5:205) The US is unlikely to risk nuclear war in a variety of antisatellite scenarios. The assumption that any use of ASATs would amount to "national suicide", and that the US would automatically escalate simply because the US relies heavily on its satellites for a variety of functions, reveals the persistent incoherence of the US debate on deploying ASATs. (11:136) The next section continues the debate, but within the arena of conventional conflict.

ASATS USED IN CONVENTIONAL CONFLICT

On conventional conflict, Stares is equally guilty of the preoccupation with escalation to nuclear catastrophe from any use of ASATs. However, he ignores the real circumstances in which either the Soviet Union or the US might plausibly use ASAT weapons. For example, the Soviets could use ASATs as an outgrowth of a conventional invasion of a Middle Eastern country. (5:211-214) Although nuclear deterrence has been a stabilizing factor in superpower relations over the past forty years, "nuclear deterrence. . . will not prevent the birth of a novel means of warfare or defense." (8:266) Space warfare is novel--and bloodless--and thus may violate the belief that nuclear deterrence inhibits the superpowers from direct military conflict.

The Soviets "continue to prepare to fight and to win a space war should it--in their view--be thrust upon them." (5:14) If the Soviets were to correctly perceive weakness in US commitment, credibility, or capability during a crisis, they may be tempted to pursue an aggressive, perhaps risk-prone, but not necessarily irrational set of limited actions to include the use of ASAT weapons. (20:121) To assume that

these limited actions will result in US escalation to higher levels of conflict denies the underlying dynamics of deterrence--the US, fearing escalation, will deter itself from expanding the scope or intensity of the conflict. (9:23) Reasons often used to justify the US ASAT program--deter attacks on satellites and respond-in-kind if attacked--are themselves justified in terms of reducing the likelihood of escalation to more intense levels of conflict. (21:45)

Without either an ASAT system or a survivable satellite deployment strategy, the US may not be able to deter the most plausible Soviet ASAT attacks, especially those that would be directed at removing some small military obstacle such as an intelligence-gathering satellite in preparation for a Soviet invasion on their Eurasian periphery. (5:211-213; 11:126-127) Attacking US eyes and ears in space could leave the Soviets in a position to present to the West a *fait accompli* similar to Afghanistan in 1979. The US reaction to similar past Soviet behavior has been to respond other than militarily--if at all. (5:212) But, if the stakes are large and the Soviets conduct ASAT operations to improve their chances for success, it is in the interest of the US to at least respond in some way without risking escalation to higher levels of conflict.

In some scenarios, the very knowledge that ASAT forces are being brought to a higher state of alert could modify an adversary's plans in space. (20:96) For example, if intelligence suggests that the Soviets are preparing to launch a Radar Ocean Reconnnaissance Satellite (RORSAT) to track a US surface fleet during a crisis, the US could bring its ASAT forces to alert, assuming of course that the US had such a force. This threat of ASAT attack might dissuade the Soviets from launching the satellite for fear that the show of force will actually lead to destruction of their satellite if launched. On the other hand, the Soviets may choose to risk the loss of their satellite in the knowledge that it can be quickly replaced. Thus their satellite deployment strategy reinforces their ability to use their space systems even when threatened. As it is, the US does not have an ASAT system and would be unable to deter aggressive Soviet satellite activity.

Pursuing the above scenario further, prudent strategy and tactics would demand an array of options to deny the Soviets detailed targeting information on US naval forces. This includes ASATs. However, without an ASAT the US must use indirect methods to negate the targeting capabilities of Soviet satellites. This clearly has its attendant hazards. In the face of many Soviet sea, air, and space reconnaissance assets, the full range of countermeasures will be needed to defeat them. Some countermeasures may be more or less effective in the face of many well-coordinated reconnaissance platforms. For example, although emission control (EMCON) techniques may defeat Soviet satellites, these techniques may expose the fleet to greater threats from Soviet submarines, ships, and aircraft. (11:133-134) Different countermeasures may be required to defeat these threats. These other countermeasures could

violate EMCON and result in detection by the satellites. Task force location would then be passed to Soviet attack submarines and cruise missile carrying aircraft. The option to shoot down the hostile satellite with an ASAT would have increased US operational flexibility in this scenario.

A US ASAT capability could also prove useful in deterring attacks on manned spacecraft. The Soviets have "long considered the US space shuttle to be a potential ASAT device." (11:112; 14:31) This probably means that the Soviets would consider targeting the Shuttle with their ASAT in some scenarios. Destruction of the Shuttle may indeed be a Soviet planning option. A corresponding US ability to hold at risk the Soviet MIR space station provides a disincentive for the Soviets to interfere with Shuttle operations. Moreover, a US ASAT capability allows a tit-for-tat US response if the Shuttle is indeed interfered with.

Any use of a US ASAT system against Soviet satellites could well induce a response-in-kind. Likewise, Soviet attacks against US satellites could lead to a tit-for-tat response. Because of greater US dependence on satellites, a tit-for-tat response does not fully justify a US ASAT. (11:5; 12:22) What is justified is an ability to rapidly launch and replace damaged or destroyed satellites. This would decrease the effectiveness of attacks on US satellites and preserve those functions best performed by space-based assets. Moreover, having many single-purpose satellites already in orbit would further degrade the effectiveness of an attack. If enough assets are in place, damaging or destroying several satellites may not significantly reduce capability. This same concept of devaluation applies even if a threat to US satellites arises from third parties.

ASATS AND THIRD PARTY ISSUES

The presence of third party space systems has complicated the military use of space. As the French SPOT demonstrated during the Chernobyl accident in 1985, other countries and even news organizations may build or buy satellites that have basic reconnaissance capabilities and thus inherent military capabilities. (18:164) Many countries will even launch the satellites for a price (e.g., Japan, Soviet Union, France, China). This could be a stabilizing trend. Some believe that "the advent of other national surveillance systems could. . . reduce the potential for space warfare." (5:205) On the other hand, both Soviet and US military planners may see these systems as "a further proliferation of potentially hostile satellites." (5:205) This could present a serious security dilemma to policy makers in the future.

Satellites owned and operated by US allies pose one such dilemma. Without an ASAT the US would be hard-pressed to respond in a measured and proportionate way to a Soviet attack on an ally's satellite. It is

beyond imagination that the US would go so far as to risk nuclear war in this case. But no response could devastate US prestige and power throughout the free world. The Soviets could view US inaction as a greenlight to pursue similar aggressive actions in the future. (5:213)

Satellites owned and operated by Soviet allies pose another difficult dilemma. "If. . . the United States were to negate Soviet surveillance satellites, [the US] could not be sure that the Chinese, French, or Indians would not come to the aid of the USSR with their own space surveillance systems. France and India have long space ties to the Soviet Union, and China might easily side with a brother Communist nation against the US." (5:205) Any US plan to attack Soviet satellites would need to consider the space assets of Soviet allies as potentially hostile.

If the superpowers perceive third party satellites as threats and, thus, as potential targets, other spacefaring nations may someday see it in their interests to develop ASAT weapons as a way to deter aggression against their fleets of satellites. These ASAT forces would function analogously to the British and French independent nuclear forces today. (24:55) Admittedly, this is an unlikely--but not impossible--future. Nonetheless, the proliferation of military satellites will increase incentives for ASAT proliferation.

The historical record provides evidence that incentives for ASAT proliferation may be developing. There have been several reports alleging that the superpowers have passed satellite-gathered intelligence to client states to support a conflict. Some examples are the 1973 Yom Kippur War in the Middle East, the Falklands/Malvinas conflict in 1982, and most recently the Libyan/Chadian conflict in Africa. (11:121-122) Some countries may wish to deny this type of support to their enemies in the future. They may try to acquire crude but effective ways to jam or otherwise interfere with satellites as they pass over regions of conflict. The most likely source for these capabilities would be the Soviet Union, including the space surveillance data needed to employ the interference devices. Clearly, the likelihood of other countries actually acquiring ASAT capabilities is debatable. But, in a world where highly sophisticated and lethal weapons are routinely given or sold to client states, often in great quantities, this type of activity is definitely possible.

The US should make every effort to prevent these undesirable futures. The US must anticipate "that states will not willingly acquiesce in unrestricted use of outer space for activities which may jeopardize or interfere with national interests." (10:55) Some nations will have legitimate reasons for having ASATs, namely deterrence. Other nations, otherwise virtually closed to foreign inspection, may seek ways to deny unrestricted access to their borders from space. Today's *tacit modus vivendi* of unrestricted and unconstrained reconnaissance from space could be challenged by any nation that can develop or buy the

technologies and capabilities needed to interfere with satellites. (11:186) In the face of this threat, if it materialized, any actions by the US to reduce vulnerability of its satellites vis-à-vis the larger Soviet threat would effectively thwart this smaller threat. With a devaluation strategy, satellites could be quickly launched with customized countermeasures appropriate to the interference techniques applied against them. Customized countermeasures to the threat from more advanced ASATs, however, may not be available to the space-based elements of a ballistic missile defense system.

ASATS AND BALLISTIC MISSILE DEFENSES

The final issue is the relationship of ASATs to ballistic missile defenses (BMD). Many of the technologies being explored in the Strategic Defense Initiative (SDI) for use in ballistic missile defenses are likewise being explored for use in an ASAT role (see Chapter Two). Dr. Robert Bowman, president of the Institute for Space and Security Studies, has succinctly stated the relationship between ASATs and BMD.

> In one sense, ASATs and ABMs [antiballistic missiles] are very different. The mission of an ASAT is easily accomplished. Its targets are extremely vulnerable, sensitive, complex sitting ducks. . . drifting predictably through the ocean of space. The mission of an ABM, on the other hand, is enormously difficult. . . . Yet there are important similarities. . . . They use much of the same technology and potentially much of the same hardware. The functions to be performed by the subsystems are identical. The differences are in the requirements for reaction time, accuracy, and power. In every case, the ABM mission is the more difficult. The result is that any system designed for an ABM mission, even if it turned out to be a complete failure in that role, would most likely be an extremely effective ASAT. (1:76-77)

The very technologies that make space-based BMD possible will result in the development and deployment of increasingly effective ASATs. Advanced ASATs may threaten space-based elements of a BMD system to such an extent that deployment presents too great a risk. The Office of Technology Assessment asserts that "the relative roles of antisatellite weapons, countermeasures, and arms control will be strongly affected by the course followed in the development and deployment of space-based BMD systems." (13:iii) What may be more suggestive is that space-based BMD systems will be strongly affected by the development and deployment of increasingly capable ASAT systems. Clearly, satellite survivability will be crucial to any decision to deploy a BMD system in space.

Satellite survivability in the face of advanced ASATs will need to be addressed before deployment of any BMD system that relies on a space-based element. The fundamental issue is that an "ASAT attack on. . .

[space-based] components [of a BMD system] is probably the cheapest and most effective offensive countermeasure." (7:185) Deployment of increasingly capable ASAT systems could entirely preclude the option of basing a portion of a BMD system in space. A case in point is if the US decided to deploy a space surveillance system in space that had the additional capability of targeting incoming reentry vehicles for a ground-based interceptor. An accelerated Soviet ASAT test program would force US policy makers to rethink their decision to deploy these sensors in space. Because of survivability considerations, the idea of basing this or any other major BMD components in space would be regarded less favorably.

In summary, this chapter has explored four issues fundamental to the debate over the relationship between ASATs and satellite deployment strategies. This debate has centered on whether ASATs are a destabilizing factor in superpower relations. This chapter has argued that the current US reliance on nonsurvivable satellites and the imbalance in superpower ASAT capabilities are the true destabilizing factors. Moreover, third party development of militarily useful satellites and growing incentives toward ASAT proliferation could bring unwanted complexities to the military use of space. Finally, the technology overlap between ASATs and BMD will jeopardize any BMD satellite deployment strategy. In the next chapter, conclusions and recommendations are presented that address these issues and, at the same time, show a way to strengthen US military space strategy.

Chapter Five

CONCLUSIONS AND RECOMMENDATIONS

> It is a doctrine of war not to assume the enemy will not come, but rather to rely on one's readiness to meet him; not to presume that he will not attack, but rather to make one's self invincible.
>
> \- Sun Tzu (3:114)

The discussion in the previous chapters has shown that satellite deployment strategies and antisatellite weapons are fundamentally interdependent. They represent two interlocking aspects of military space strategy. How satellites are deployed and what weapons are available to attack an enemy's satellites determine whether a particular military space strategy enhances national security or breeds dangerous instability in superpower relations. Several conclusions about ASATs and satellite deployment strategies can be drawn from this discussion. These conclusions lead to recommendations for strengthening US military space strategy.

CONCLUSIONS

The discussion in the preceding chapters supports the following conclusions:

The US today is not ready to meet an enemy in space. The US space program is well-suited for peacetime operations but dangerously ill-prepared to deter or conduct warfare in space. The US space program is unusually fragile and lacks reserves for crisis or contingencies.

The nuclear balance will continue to moderate conflict, but space will become more and more attractive as an outlet for aggressive superpower behavior.

ASATs can deter aggressive satellite activity. Survivable satellite deployment strategies can deter aggressive ASAT activity. Pursuing either an ASAT program or a satellite devaluation strategy alone will not support US national objectives. The security of the US needs the synergistic effect of both.

Soviet deployment of increasingly capable ASAT weapons will force the US to adopt a more survivable satellite deployment strategy. United States

deployment of effective ASAT weapons will add balance to superpower relations in space. Space then becomes a more deadly place, but, paradoxically, less dangerous.

The Soviets have demonstrated that the single-purpose satellite is perfectly suited to exploit the environmental advantages of space.

As advanced ASAT weapon technologies mature, satellites will become more and more vulnerable to ASAT attack. This will be a critical issue in the continuing debate over SDI.

As other countries launch satellites with inherent military capabilities, both US and Soviet military space strategies will face increasing complexity.

RECOMMENDATIONS

Consistent with the conclusions from above, the following recommendations are offered as ways to strengthen US military space strategy:

The US should treat space as a possible theater for war.

The US should aggressively pursue a variety of ASAT development programs including earliest possible deployment of the F-15 Air-Launched ASAT. Fielding more than one type will hedge against countermeasure development and add operational flexibility to any employment decision.

The US should adopt a more survivable satellite deployment strategy suggestive of Soviet practices. This would involve a strategy of satellite devaluation and would consist of three elements: (1) place into orbit larger constellations of smaller, single-purpose satellites; (2) stockpile satellites and boosters to ensure damaged or destroyed satellites are rapidly replaced; and (3) build a launch and on-orbit support infrastructure that can deploy and support the larger number of satellites in orbit.

SUMMARY

If the future history of man reveals that wars were indeed fought in the environment of space, then space battles would be won or lost by destroying satellites. To win in space, effective weapons are needed--and satellites that can survive and endure the battle. Former Air Force Chief of Staff General Thomas D. White reflects the sense of urgency US military space planners should feel in preparing for war in space.

> We should be racing toward a new potential in warfare. The future military value of space power may transcend that of air power today. There are military requirements in space which this nation can fail to fulfill at its grave peril. Control of the universe, including our own Earth, is at stake. (5:8)

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